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Effect of abdominal negative-pressure wound therapy on the measurement of intra-abdominal pressure

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ABSTRACT

Background: In critically ill surgical patients undergoing abdominal negative-pressure wound therapy (NPWT), it remains uncertain whether or not intra-abdominal pressure (IAP) measurements should be obtained when NPWT is activated. We aimed to determine agreement between IAP measured with and without NPWT.

Methods: In this analytic cross-sectional study, critically ill surgical adults (≥18 y) requiring abdominal NPWT for temporary abdominal closure after a damage control laparotomy were selected. Patients with urinary tract injuries or with pelvic packing were excluded. Paired IAP measures were performed in the same patient, with and without NPWT; two different operators performed the measures unaware of the other's result. Bland-Altman methods assessed the agreement between the two measures. Subgroup analyses (trauma and nontrauma) were performed.

Results: There were 198 IAP measures (99 pairs) in 38 patients. Mean IAP with and without NPWT were 8.33 (standard deviation 4.01) and 8.65 (standard deviation 4.04), respectively. Mean IAP difference was −0.323 (95% confidence interval −0.748 to 0.101), and reference range for difference was −4.579 to 3.932 ($P = 0.864$). From 112 IAP measures (56 pairs) in 21 trauma patients, mean IAP difference was −0.268 (95% confidence interval −0.867 to 0.331), and reference range for the difference was −4.740 to 4.204 ($P = 0.427$).

Conclusions: There was no statistically significant disagreement in IAP measures. IAP could be measured with or without NPWT. In critically ill surgical patients with abdominal NPWT for temporary abdominal closure, monitoring and management of IAP either with or without NPWT is recommended.

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Introduction

There continues to be a need for reliable monitoring of intra-abdominal pressure (IAP) in patients with high risk of developing abdominal compartment syndrome (ACS) because of increased intra-abdominal hypertension (IAH) after abdominal catastrophes or trauma requiring damage control laparotomies.[1] Many advances have been made based on the evidence-based recommendations promulgated by the World Society of the Abdominal Compartment Syndrome (WSACS).[1] However, not all recommendations are based on high quality evidence. There is debate regarding practical aspects for obtaining reliable IAP measurements in critically ill surgical patients.[2]

The critically ill or injured patient undergoing laparotomy for traumatic or nontraumatic surgical emergencies and suffering from physiologic exhaustion often require damage control strategies, including open abdomen and abdominal negative-pressure wound therapy (NPWT).[3,4] These patients are at risk for developing IAH and ACS, and in these patients, IAP should be measured and monitored.[1] To our knowledge, it is not known whether or not IAP should be measured when NPWT is activated. The aim of this study was to determine correlation and agreement between IAP measured with and without NPWT. We hypothesize that correlation is low and that agreement does not exist in IAP measurements when NPWT is activated and when it is not.

Methods

A cross-sectional study design was conducted during September 2015-June 2016 at intensive care unit (ICU) in the Fundación Valle del Lili, Cali, Colombia, a university hospital that also meets all the criteria that a United States level I trauma center must fulfill to be designated as such by the American College of Surgeons. Adults (equal or greater than 18 y old) critically ill and admitted to the ICU in whom an exploratory laparotomy was performed for traumatic or nontraumatic surgical emergencies and who required a damage control strategy with abdominal NPWT for temporary abdominal closure, were selected for inclusion in the study. Patients with pelvic packing due to uncontrolled hemorrhagic and patients with documented urinary tract injuries or with oncologic lesions compromising the urinary tract were excluded. After surgery and during ICU stay, paired IAP measures were performed in the same patient with and without NPWT by two different operators; both were unaware of the other's result. The main analysis was to assess correlation and agreement between IAP measured with and without NWPT, using Pearson's correlation coefficient and the Bland-Altman statistical method. This study was reviewed and approved by the Institutional Review Board at the Fundación Valle del Lili.

IAP measurement protocol

Clinical examination is inaccurate for detecting raised IAP; therefore, researchers and clinicians rely on serial or continuous IAP measurements. The trans-bladder method remains the most widely used for IAP measurement and monitoring, and the recommended method by the WSACS.[1,5] It uses indwelling urethral catheter connected to either a transducer or a saline manometer, and it is preferred because it is relatively noninvasive, simple, reproducible, and low cost.[1,6] Therefore and according to the WSACS consensus recommendations, a standardized protocol for trans-bladder IAP measure and monitoring in all ICU at the Fundación Valle del Lili has been adopted as the standard of care in critically ill or injured patients with known risk factors for IAH or ACS.

In our institution, IAP is measured and monitored in critically ill or injured patients with the following risk factors: diminished abdominal wall compliance such as major abdominal trauma or major abdominal surgery; increased intraluminal or intra-abdominal contents such as ileus (including postoperative ileus), colonic pseudo-obstruction, acute severe pancreatitis, hemoperitoneum, intraperitoneal fluid collections, or intra-abdominal or retroperitoneal infections; increased capillary leak such as those with hypothermia, increased acute physiology and chronic health evaluation (APACHE) or sequential organ failure assessment scores, coagulopathy, massive fluid resuscitation, positive fluid balance, polytransfusion, or those who required a damage control laparotomy with abdominal NPWT for temporary abdominal closure. In addition, IAP is measured and monitored in critically ill or injured patients with abdominal sepsis, septic shock, or hemorrhagic shock.

Figure 1 illustrates the trans-bladder method used for IAP measurement and monitoring in patients who underwent exploratory laparotomies for traumatic and nontraumatic surgical emergencies and who require damage control strategies with NPWT for temporary closure of the abdomen.

During IAP measurement, a patient is placed in supine position and sedated to a Richmond Agitation Sedation Score of −4.[7] Under sterile conditions, a commercial IAP monitoring system, (AbViser IAP Monitoring System Wolfe-Tory Medical, Salt Lake City, UT), is attached to the urethral catheter, the bladder is drained, and the stopcock is closed to the urine collection bag and opens to the bladder and the monitoring

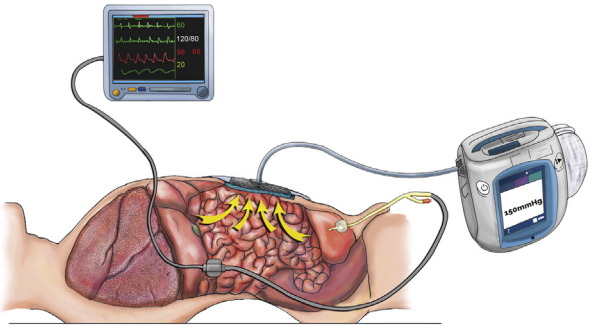

Fig. 1 – Trans-bladder method used for intra-abdominal pressure measurement and monitoring in patients who underwent exploratory laparotomies for traumatic and nontraumatic surgical emergencies and who require damage control strategies with negative-pressure wound therapy for temporary closure of the abdomen. (Color version of figure is available online.)